

## **History of Weather Observations**

According to Roof and Callagan (2003), weather observations in Death Valley were first taken in the 1860s by government surveys, but it was not until 1891 that a consistent set of weather observations were taken in Death Valley. These began on April 30, 1891 and lasted until September 30<sup>th</sup> of that year as part of a weather station established under a survey conducted jointly by the U.S. Geological Service and the U.S. Signal Service. This station was established at the Pacific Coast Borax Company in a building known as the "Coleman". John H. Cleary was appointed the observer in charge and Mr. R.H. Williams was the assistant but Mr. Williams had to leave soon after his arrival as he fell ill because of the heat. The weather station was equipped with standard weather equipment used by cooperative weather observers including maximum and minimum thermometers in a shelter and a standard rain gauge. In addition, an anemometer, psychrometer, barograph and thermograph were installed. A report published in the first U.S. Weather Bureau Bulletin 1892 by Mark Harrington titled *The Climate and Meteorology of Death Valley, California* provides extremely detailed descriptions of the weather equipment used at the time. Given it was known that this area was extremely hot, thermometers that could read higher readings were ordered. Extremely detailed observations of the weather including cloud cover and cloud type and beginning and end times of precipitation were also taken.

In 1911, a permanent weather station was finally established in Death Valley at the Greenland Ranch. Greenland Ranch was located across the street from what is today the Furnace Creek Ranch. According to Willson (1915), arrangements were made between the United States Weather Bureau and the Pacific Borax Company to establish and maintain a weather station here. On June 8, 1911 observations of maximum and minimum temperature for a twenty four hour period along with precipitation began. The station was located at 178 feet below sea level. The initial thermometers were housed in a shelter located four feet above the ground with the shelter door facing north and 50 feet from the nearest object. The ground below the shelter at this time was alfalfa sod. The rain gauge was located 30 feet from the nearest high object with the top 4 feet above the ground. The ranch foreman was given the job as the station's observer. The station's first observer was T. Osborn.

No changes were made with the location of the equipment until 1924, when on March around the 22<sup>nd</sup> the rain gauge was moved about five feet to have it located further away from the thermometer shelter. This placed the rain gauge now six feet to the east of the shelter. The gauge was also raised up eighteen inches higher.

On September 1, 1929 the entire Greenland Ranch weather station was moved about 310 feet to the north. The weather station was then placed in a fifteen foot square wire fence enclosure. Another major move came around January 1, 1938

when the entire station was moved 40 feet west because of highway construction. The elevation at this later location was about 172 feet below sea level.

On November 20, 1934 an agreement was made to establish a weather station at Cow Creek in Death Valley. On December 3, 1934 a weather station was established at Cow Creek. This weather station was located at the offices for the National Park Service which were located at Cow Creek at the time. The Cow Creek station was located further north and at a slightly higher elevation than the weather station at Greenland Ranch and is not considered a climatologically compatible station. An evaporation station was set up at Cow Creek on April 16, 1958.

In late October 1954, the Greenland Ranch station was moved to 310 feet north and east to an area with open ground below it and with the instrument shelter located three and a half feet above the ground. The station was located about 100 feet east of Highway 190 at this time in an area over bare ground in a fenced in enclosure with the shelter facing north. The area was located about 800 feet east of a date grove. The elevation at this point was listed as 168 feet below sea level.

During the early 1950s, problems began to develop with the weather observations taken at Greenland Ranch. After reviewing and comparing temperatures, officials from the Weather Bureau including the California State Climatologist came across a number of suspect temperatures that appeared inaccurate after consistency checks with the station at Cow Creek. In order to cross check observations more carefully, a thermograph was installed at the Greenland Ranch station on March 22, 1954. The thermograph could then be used to ensure the temperatures taken by the observers were accurate. One large source of the errors was found to be the observer at the time who had vision problems and needed eyeglasses to read the thermometers even in the daytime. The observer even opted to take observations at 7 PM in the dark. The weather bureau then recommended having the observations read during the evening before it became dark in March of 1954.

On May 1, 1955 further problems with the observers at Greenland Ranch began when the observer decided to change the time of observation to a morning reading. Upon a station inspection visit in March 1956, the Weather Bureau learned the longtime observer at the Greenland Ranch was to retire and a new observer would be taking over. The new observer informed the Weather Bureau representative that he was trained to log the observations on the observer form one day back. The new observer stated he was very suspicious of how the previous observer was recording the observations but complied because the previous observer had been there a long time. On March 11, 1956 the observation time was changed back to the evening.

It appeared hopeful for the United States Weather Bureau that the new observer would be enthusiastic in taking the observations, however this turned out not to be the case. By June 1, 1956 the new observer began taking the temperatures in the morning once again as this turned out to be a more convenient time for them. During a station visit on March 21, 1957 it was found the observer was recording the observations at Greenland Ranch but not sending the forms into the United States Weather Bureau. However, the new observer not only worked for Pacific Coast Borax Company but also the Fred Harvey Company which by that time had taken over running the Furnace Creek Ranch and also worked as a local sheriff. As a result of his many jobs, it became increasingly difficult for him to find time to take observations. A thermograph continued in operation to allow for a cross check of observations.

Observations continued to be taken by the observer from the Pacific Borax Company through the summer of 1957. However, by September of that year, the observer became "too busy" to take observations and stopped taking them. The observer at the time stated that when a new thermograph was installed and failed, he became disinterested in the observations and completely ceased taking them. This gap in observations lasted through the end of February of 1958. On March 1, 1958 the National Park Service took over observations at the Greenland Ranch site after the United States Weather Bureau convinced the park service to send staff to the area from their nearby office at Cow Creek in order to keep the records going. The National Park Service also was going to be relocating their visitor center from Cow Creek to Furnace Creek, which eventually was thought of as a new location for the weather station. The period from September 1, 1957 through February 28, 1958 marks the largest period without weather observations of any sort being taken in the Greenland Ranch area.

On April 1, 1961, the official weather station moved to the new Furnace Creek Visitor Center operated by the National Park Service. At this time, the name of Greenland Ranch was also changed officially on the station name listed on weather records. It was felt by the National Park Service at the time that the name "Greenland Ranch" had fallen out of use in this area. An inspection report from the U.S. Weather Bureau at the time states the Greenland Ranch was now called the Furnace Creek Ranch and was "just as green if not greener than formerly". The new station was located a half of a mile to the north of the date grove that was located 800 feet west of the previous station. On April 25, 1961 the evaporation station was closed at the Cow Creek Visitor Center station and relocated to Furnace Creek. The new station was located at an elevation of 194 feet below sea level. On July 1, 1961 a 4 foot chain link permanent fence was erected around the weather station at Furnace Creek. Outside of changes in the vegetation around the station with some nearby trees and creosote bushes having grown taller, the natural setting of the station remains the same as it was when it was first installed in April 1961.

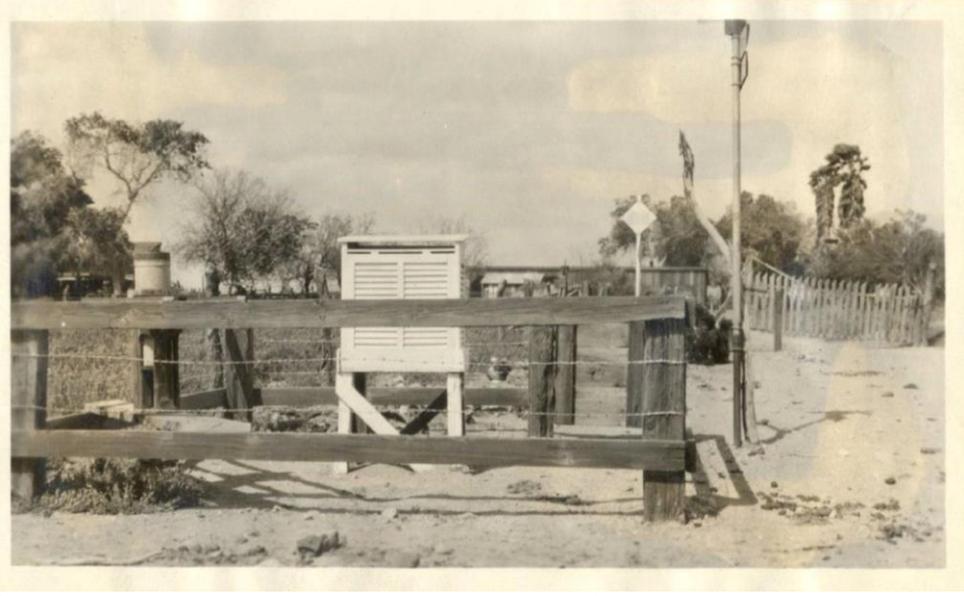
On April 4, 2012, an automated Campbell Scientific weather station was installed in the weather station enclosure at Furnace Creek by the National Weather Service in hopes of modernizing the way of obtaining weather reports at Death Valley and allowing for real-time information to be collected. This station consisted of an electronic temperature sensor, humidity sensor, tipping bucket rain gauge, wind vane and anemometer. This weather station was able to transmit hourly, real-time weather observation with the ability to read temperatures up to 140 degrees. This weather station was tested for a little over three years by comparing readings to the legacy weather station. On November 2, 2015, the Campbell Scientific weather station became the primary means for collecting observations and the official observing time switched to Midnight Local Standard Time allowing observations to represent the calendar day ending the practice of observational day readings. The legacy cotton region shelter with liquid-in-glass thermometers and eight inch standard rain gauge were left on-site to serve as back-up equipment. This largely automated for the first time ever the routine collection of weather observations at Death Valley.



This is the oldest known picture of the weather station at Greenland Ranch in Death Valley likely taken at the latest in 1921. It was published in *Monthly Weather Review* by the United States Weather Bureau in January 1922. Image Credit: American Meteorological Society.



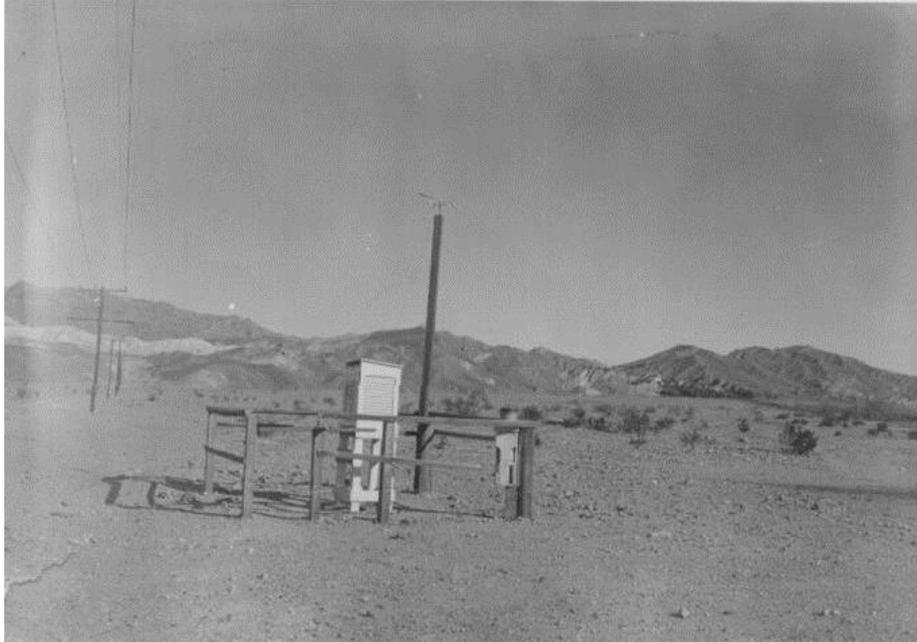
This picture of the weather station at Greenland Ranch in Death Valley was taken during a station visit in March 1924 prior to the rain gauge being moved. Photo Credit: NWS Las Vegas archives.



The Greenland Ranch weather station in Death Valley after the rain gauge was moved. It was taken in March 1924. Photo Credit: NWS Las Vegas archives.



During a station inspection to Greenland Ranch in March 1924, two unidentified individuals posed for this photograph at the weather station. Photo Credit: NWS Las Vegas archives.



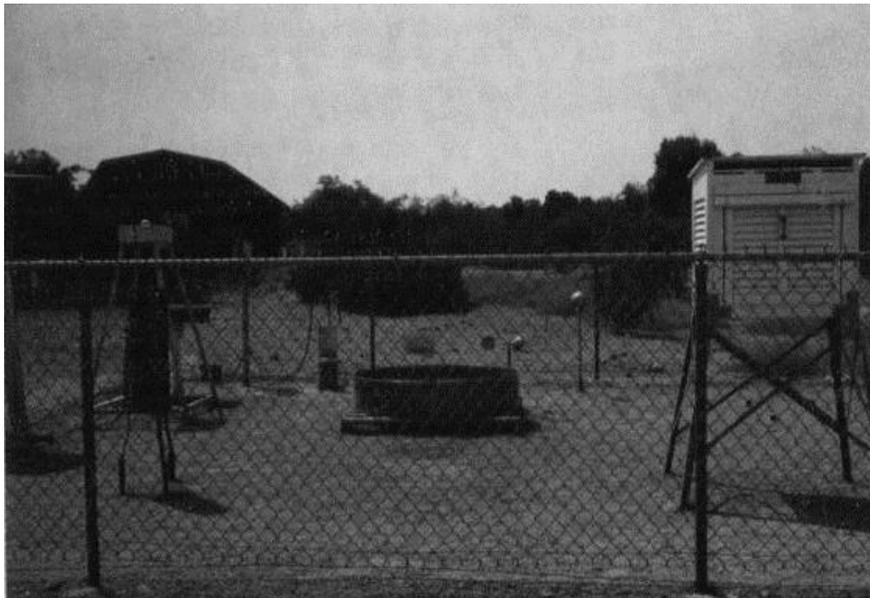
On March 8, 1960 this photo of the Greenland Ranch (then Furnace Creek Ranch) weather station was taken after a new instrument shelter was installed. The Furnace Creek Inn can be seen in the upper right side of this picture. Photo Credit: Zeal Borum/NWS Las Vegas archives.



View of the weather station after moving to the Visitor Center at Furnace Creek. The instrument shelter, evaporation pan and rain gauge can all be seen in this photograph. Photo taken in August 1961 after a four and a half foot tall chain link fence was installed around the weather station. Photo Credit: NWS Las Vegas archives.



View of the weather station at the Visitor Center at Furnace Creek looking towards the Funeral Mountains. The instrument shelter, evaporation pan and rain gauge can all be seen in this photograph. Photo taken on February 20, 1962. Photo Credit: NWS Las Vegas archives.



An undated photograph of the Death Valley weather station at Furnace Creek. Photo Credit: NWS Las Vegas archives.



The Death Valley weather station in June 2008. Photo Credit: Chris Stachelski.



Thermometers inside the shelter in Death Valley in June 2008. The temperature at the time read 121 degrees. Photo Credit: Chris Stachelski.



Death Valley weather station enclosure in March 2015 showing an automated Davis-brand weather station, evaporation pan, standard rain gauge, Campbell Scientific weather station and the cotton region shelter from left to right. Photo Credit: Chris Stachelski



The Campbell Scientific weather station (shown at left) and the cotton region shelter at Death Valley. Photo Credit: Chris Stachelski